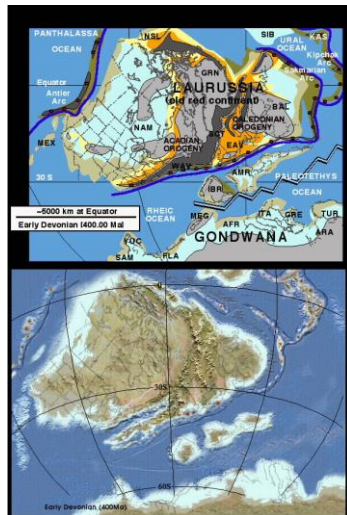


# Spodní paleozoikum Regionální přehled



## Bohemian Massif

A tectonic collage of Variscan zones

Palaeozoic volcano-sedimentary complexes in two main units:

-**Teplá-Barrandian Unit**  
(Saxothuringian Zone)

-**Moravo-Silesian Zone**  
(Subvariscan Zone +  
Renohercynian Zone)

Rheic suture in between

Modified by final shearing due to docking of the "**Armorican Spur**"

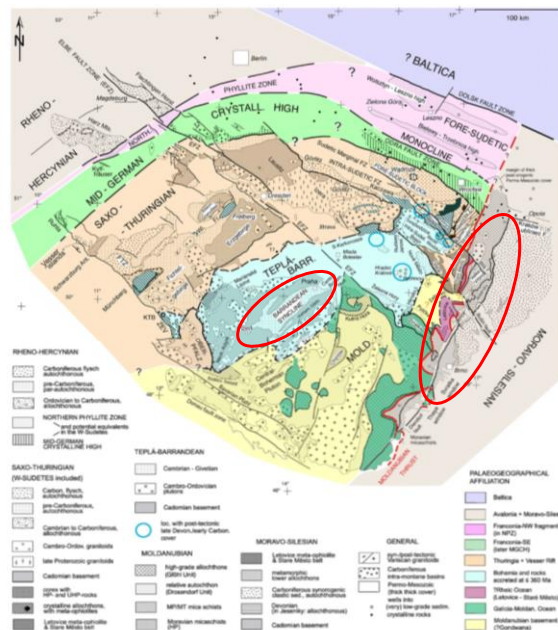
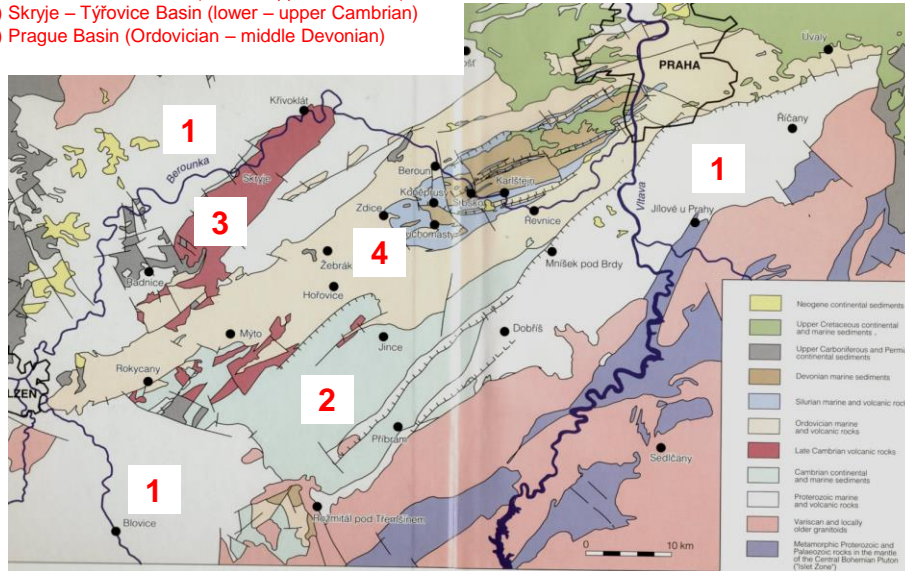


Fig. 6. Geological map of the Bohemian Massif. Colour overlay shows paleogeographical affiliations (modified from Franke, 2014 Franke and Zolotarevsky, 2002). WLF, Saxo-Thuringian tectonic klippen of Wilkendorf and Frankenberg; KTB, continental deep drilling site; ZEV, zone of Eibenstock-Vollmeubach.

Franke et al. 2017, Gondwana Research 48 258–284

## Teplá – Barrandian Unit

- 1) Proterozoic of the Teplá Barrandian (Neoproterozoic)
- 2) Příbram – Jince Basin (lower – upper Cambrian)
- 3) Skryje – Týřovice Basin (lower – upper Cambrian)
- 4) Prague Basin (Ordovician – middle Devonian)



## Lithostratigraphy: Příbram – Jince Basin

Resting upon Neoproterozoic successions with angular unconformity

Lower Cambrian: continental siliciclastics, basic volcanism

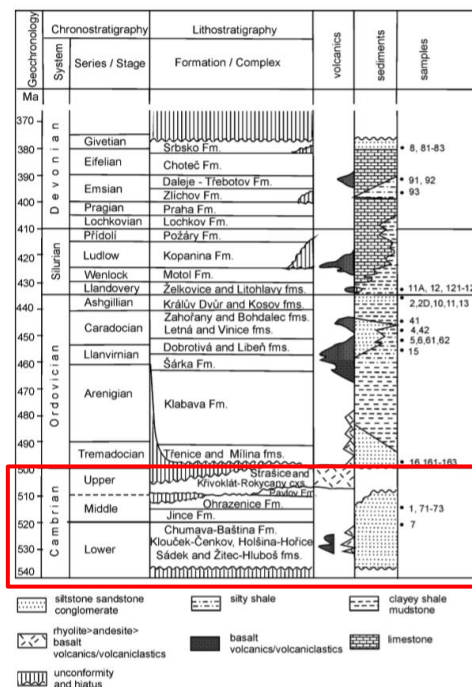
Middle Cambrian: marine transgression, trilobite-bearing shales and siltstones

Upper Cambrian – regression, continental siliciclastics and rhyolite-andesite volcanims



Sao hirsuta, Middle Cambrian, Skryje

Patočka, Štorch, 2004, Int. J. Earth Science 93, 728-741.



## Lithostratigraphy of Prague Basin: Ordovician-Silurian part

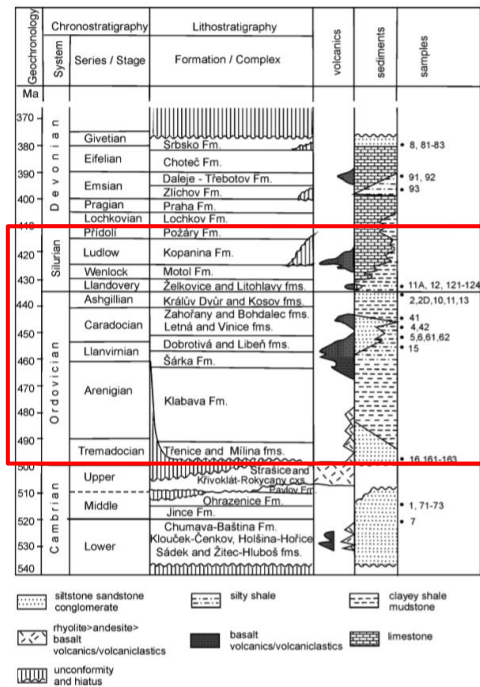
resting upon Cambrian deposits with unconformity

Ordovician: marine siliciclastics, deltaic complexes, turbidites, upper Ordovician glaci-marine deposits with dropstones (Himantian glaciation), basalt volcanism

Silurian: marine siliciclastics, graptolite-bearing black shales, orthoconid limestones, basic-ultrabasic volcanism



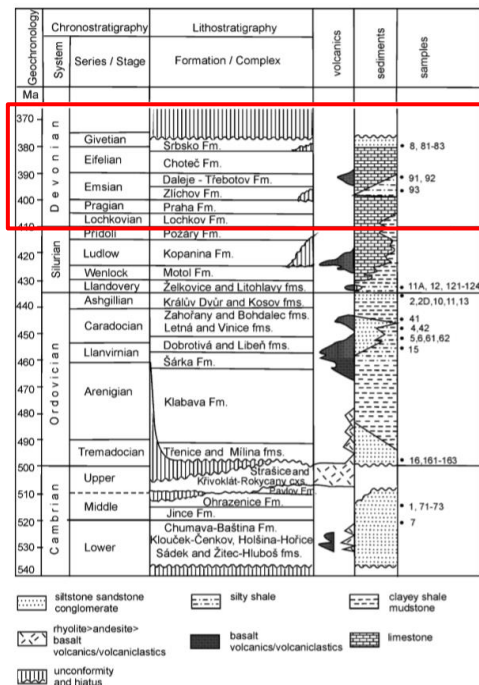
Selenopeltis trilobite, Ordovician, Prague Basin



## Lithostratigraphy of Prague Basin: Devonian

Continuous sedimentation from Silurian: GSSP Přidolí/Lochkovian at Klonek near Suchomasty

Carbonate succession – Lochkovian - Eifelian, very diverse facies + shales and basic volcanites  
 Since Givetian: demise of carbonate sedimentation, siliciclastic deposits, first onsets of Variscan orogeny





## Lithostratigraphy of Prague Basin Devonian

Lochkov Formation  
- Kotýs Member  
- Radotín Mbr.

Lochkovian/Pragian E

Praha Formation  
- Koněprusy Mbr.  
- Slivenec Mbr.  
- Loděnice Mbr.  
- Řeporyje Mbr.  
- Dvorce-Prokop Mbr.

Basal Zlíchov E.

Zlíchov Formation

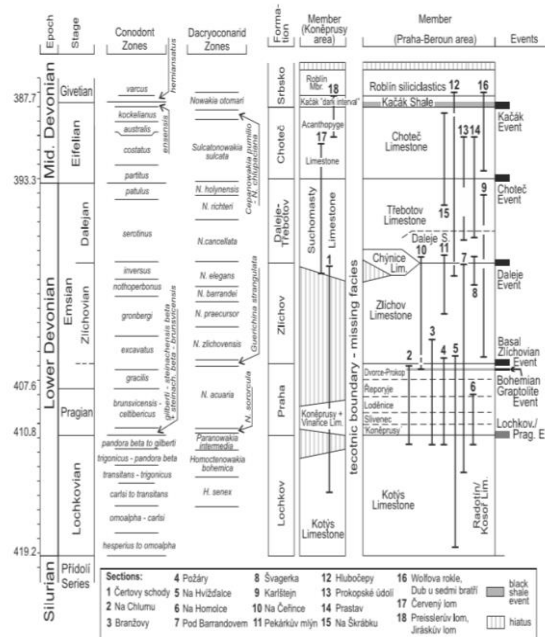
Daleje E.

Daleje-Třebotov Formation  
- Daleje Mbr.  
- Třebotov Mbr.

Basal Choteč E.

Choteč Formation  
- Kačák Shale Mbr.  
- Roblín Mbr.

Kačák E.



Praha Formation, Velká Amerika Quarry near Karlštejn



Barrande Rock, Karlštejn, S/D parastratotype



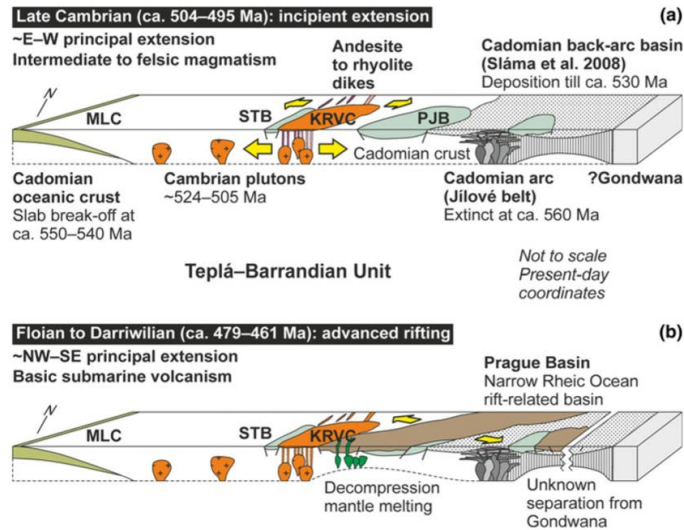
Koněprusy Limestone Mbr., Čertovy Schody Quarry



Klonk Hill near Suchomasty, S/D GSSP

## Prague Basin: part of the Rheic ocean rift system

**Fig. 9** Schematic cartoon showing the principal lithotectonic elements, the inferred styles and timing of the second phase of crustal extension (see text for discussion), and its relation to magmatic events in the Teplá-Barrandian Unit during the late Cambrian **a** to Early Ordovician times **b**. The Prague Basin is interpreted as a part of the Rheic Ocean rift system. *KRV*C, Křivoklát-Rokycany Volcanic Complex; *MLC*, Mariánské Lázně complex (ophiolite assemblage); *PJB*, Příbram-Jince Basin; *STB*, Skryje-Týřovice Basin



Žák et al., 2013. *Int. J. Earth Sci.* 102: 415–433.

## Prague Basin: geochemical provenance patterns

Geochemical provenance patterns of the Příbram Jince and Prague Basins:

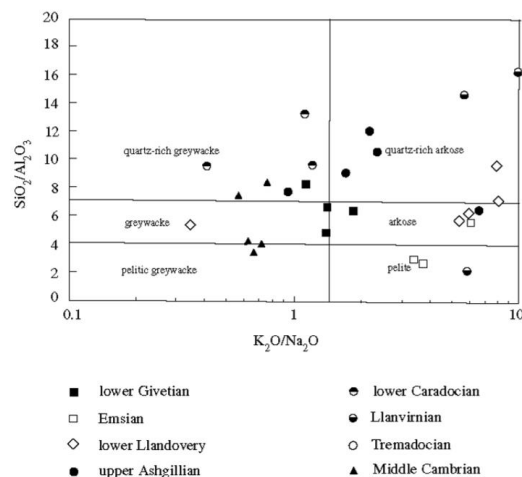
Middle Cambrian - derived from a Cadomian Neoproterozoic island arc

Ordovician – derived from a dissected Cadomian orogen.

Early Llandovery - abruptly weakened supply of terrigenous material and an elevated proportion of synsedimentary basic volcanics as a result of Silurian transgression.

Emsian - addition of coeval basic/ultrabasic volcanoclastics

Middle Devonian - indicate reappearance of Cadomian source near the Barrandian during early Variscan convergences



**Fig. 3** Early Palaeozoic siliciclastic rocks of the Middle Cambrian and Early Ordovician to Middle Devonian sedimentary sequences of the Barrandian in the geochemical classification plot after Wimmenauer (1984).

Patočka, Štorch, 2004. *Int. J. Earth Science* 93, 728–741.

## Prague Basin: geochemical provenance patterns

Geochemical provenance patterns of the Píbram Jince and Prague Basins:

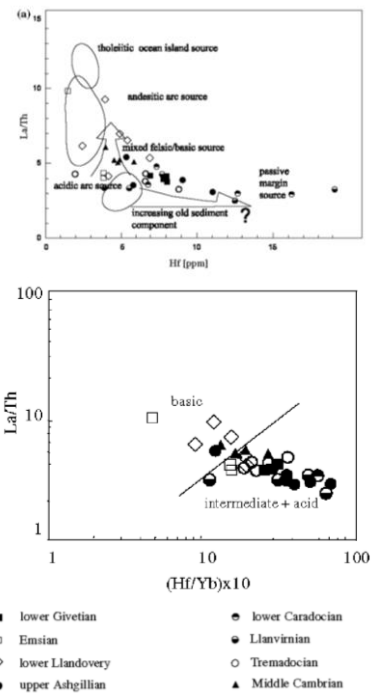
Middle Cambrian - derived from a Cadomian Neoproterozoic island arc

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Emsian - addition of coeval basic/ultrabasic volcanoclastics

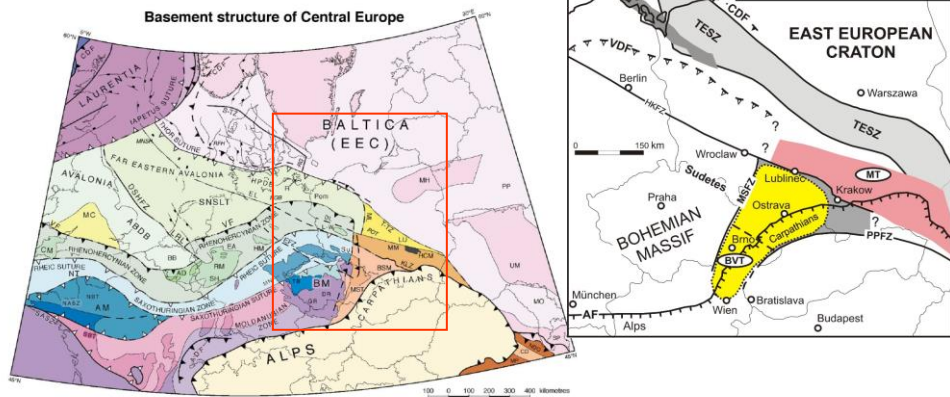
Middle Devonian - indicate reappearance of Cadomian source near the Barrandian during early Variscan convergences



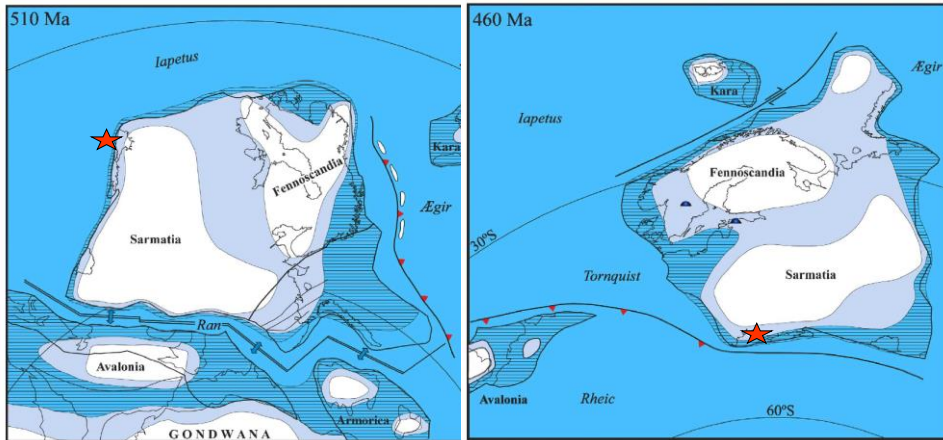
Patočka, Štorch, 2004, *Int. J. Earth Science* 93, 728-741.

## Moravo-Silesian Zone and the evolution of Brunovistulian terrane

- is regarded as extension of the Rhenohercynian and Subvariscan Zones of W Europe
- acted as lower plate at the southern margin of Laurussia
- shared similar tectonic position with Avalonia



## Brunovistulian T. and Avalonia: Different early Paleozoic histories



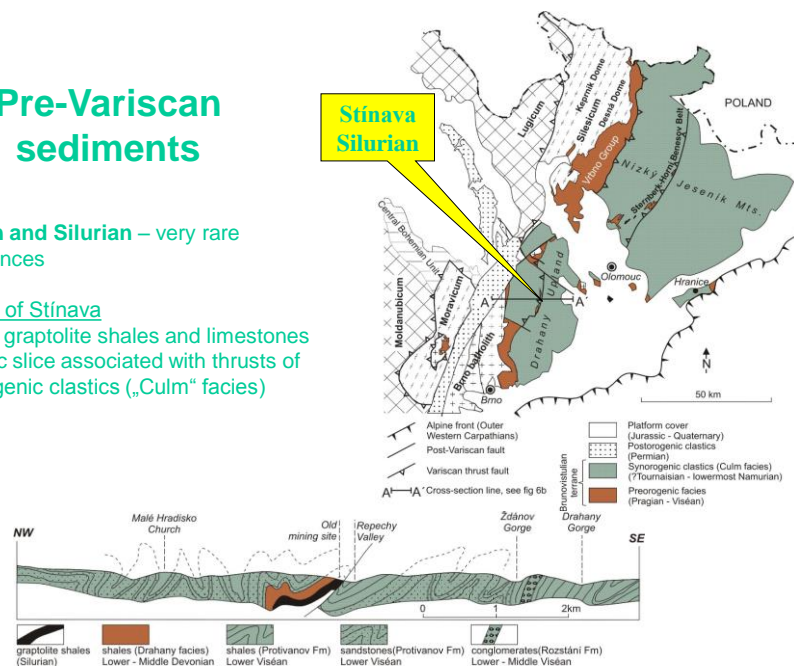
While the Neoproterozoic provenance is a matter of discussion, there is growing evidence that the terrane was **a part or close to Baltica since the Cambrian**

## Pre-Variscan sediments

**Ordovician and Silurian – very rare occurrences**

### Silurian of Stínava

- Pelagic graptolite shales and limestones
- Tectonic slice associated with thrusts of synorogenic clastics („Culm“ facies)

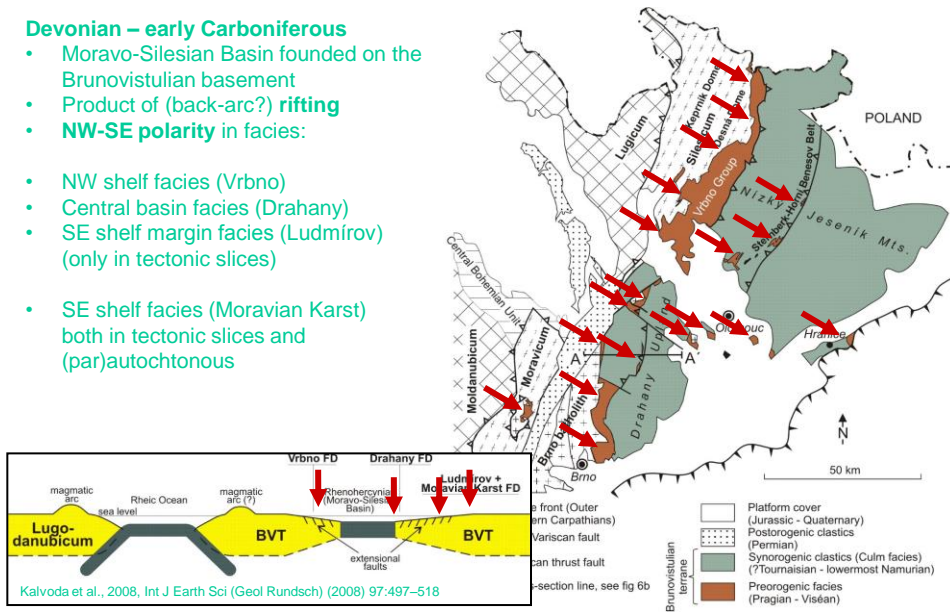




## Variscan pre-orogenic sedimentation

### Devonian – early Carboniferous

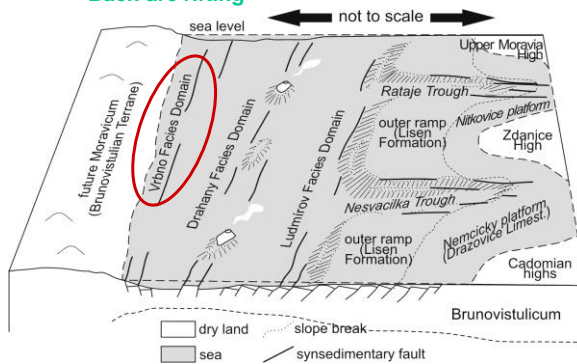
- Moravo-Silesian Basin founded on the Brunovistulian basement
- Product of (back-arc?) **rifting**
- **NW-SE polarity** in facies:
  - NW shelf facies (Vrbno)
  - Central basin facies (Drahany)
  - SE shelf margin facies (Ludmířov) (only in tectonic slices)
  - SE shelf facies (Moravian Karst) both in tectonic slices and (par)autochthonous



### NW (inner) shelf facies (Vrbno)

- **Pragian to Famennian**
- Metamorphosed to greenschist facies
- Quartzites with fauna comparable to the Taunus quartzite
- Phyllites, marbles
- Arc- and back-arc WPA and narrow segments of MORB

#### Back-arc rifting



Kalvoda et al., 2008, Int J Earth Sci (Geol Rundsch) (2008) 97:497–518

AGE		Vrbno facies (Vrbno Group)
LOWER CARBONIFEROUS	VISÉAN Upper	
	VISÉAN Middle	
	VISÉAN Lower	flysch
	TOURNAISIAN	TECTONIC BOUNDARY?
DEVONIAN	FAMENNIAN	TECTONIC BOUNDARY?
	FRASNIAN	crystalline carbonates (Helmavice Mbr.)
	GIVETIAN	black phyllite, micaschist, gneiss, greenschist, amphibolite
	EIFELIAN	
	EMSIAN	
	PRAGIAN	quartzite (Drakov quartzite), phyllite (age uncertain)
	Crystalline basement	TECTONIC BOUNDARY Brunovistulian terrane (Desná dome)

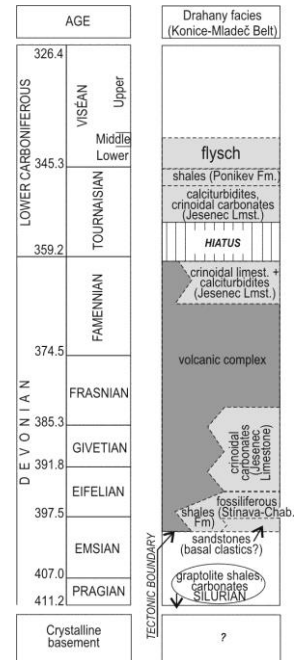
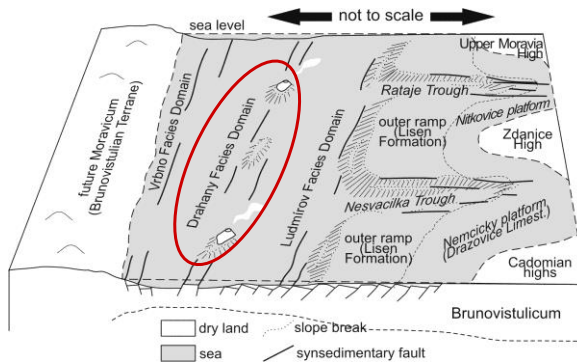


## Central basin facies (Drahany)

### Emsian to Tournaisian

- Deep-marine fossiliferous shales
- Crinoidal limestones and calciturbidites
- Submarine, bimodal WP volcanics with transition to oceanic crust basalts
- Pelagic shales with radiolarian cherts and calciturbidites

### Thinned continental crust, oceanic crust

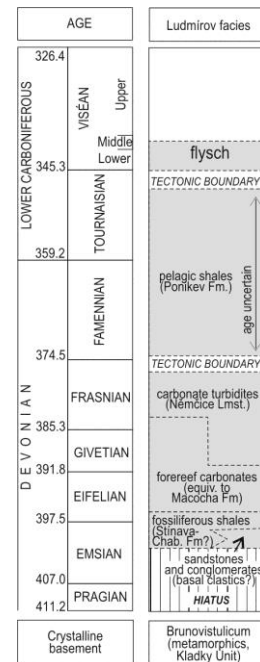
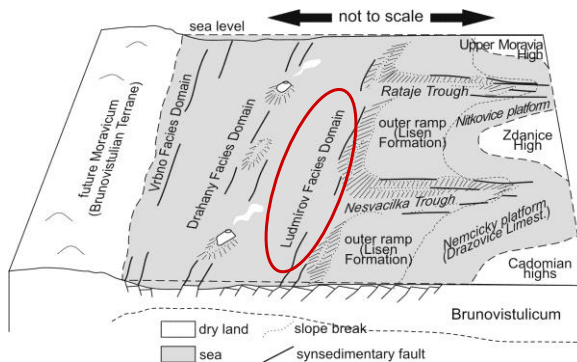


## SE shelf margin facies (Ludmírov)

### Emsian to Tournaisian

- Deep-marine fossiliferous shales
- Coral-stromatoporoid fore-reef carbonates, later calciturbidites and pelagic shales with radiolarian cherts
- Middle-late Devonian deepening-upward sedimentary succession: reflects tectonic-thermal subsidence

### Shelf-to-basin transition

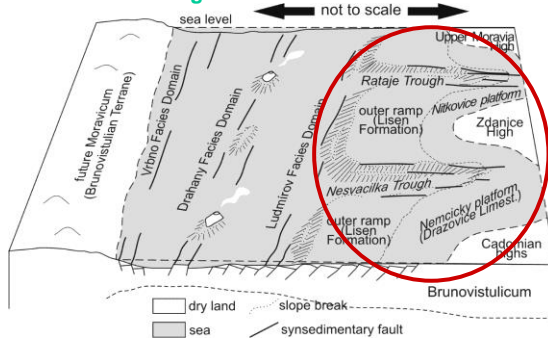


## SE (inner) shelf facies (Moravian Karst)

### Eifelian to Viséan

- Terrestrial and shallow-marine siliciclastics
- Coral-stromatopore platform carbonates
- Pelagic nodular limestones and calciturbidites
- Fossiliferous shales and limestone breccias
- Carbonate platforms, later differential subsidence, deep marine troughs and highs

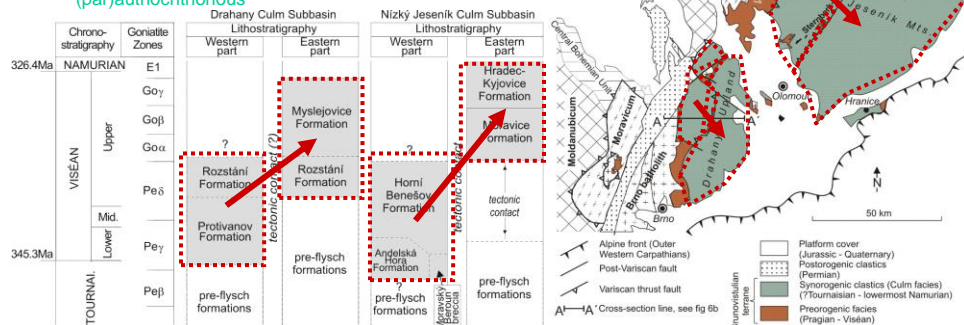
### Passive margin



AGE	Moravian Karst facies		Moravian Karst facies (subsurface, SE)
	N part	S part	
LOWER CARBONIFEROUS	VISÉAN	Upper	flysch
		Middle	algal and foraminifer platform carbonates (Hady Rocks Lmst.)
	TOURNAISIAN	Lower	shales (Bělá Fm.)
			HIATUS
DEVONIAN	FAMENNIAN		shales (Ostrov Mbr.)
			hemipelagic nodular limestones, turbidites and breccias (Lisen Fm.)
	FRASNIAN		non-reefal platform carbonates (Dražovice Lmst.)
			coral-stromatopore platform carbonates (Macoča Fm.)
	GIVETIAN		basal clastics
			terrestrial
EIFELEAN	EIFELEAN		terrestrial
			HIATUS
	EMSIAN		terrestrial, shallow-marine siliciclastics (CAMBRIAN)
PRAGIAN			HIATUS
	Crystalline basement		Brunovistulium (igneous rocks, Brno Massif)

## Syn-orogenic sediments

- Siliciclastic turbidites, gravity-flow deposits, bottom-current deposits, axial transport, NW sediment source, NE sediment dispersal, two subbasins (Drahaný and Nizký Jeseník one), eastward progradation
- **trench deposits** (late Tournaisian to mid-Viséan) fossil-free, detrital micas with Ordovician and Silurian cooling ages (Armorican provenance) (Andelská Hora, Horní Benesov, Protivanov Formations), allochthonous
- **foreland basin deposits** (late Viséan to early Namurian) fossiliferous, Viséan detrital micas (Moravice, Hradec-Kyjovice, Myslejovice Fm), (para)autochthonous



## Structure

### ALLOCHTHON (W part)

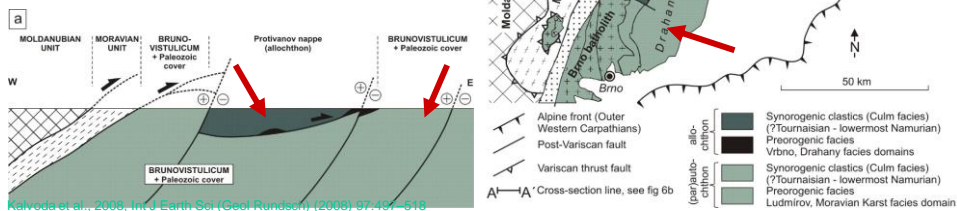
Pre-orogenic NW shelf and basin facies, the  
Silurian exotics  
Syn-orogenic trench deposits  
A strongly imbricated stack of both E-vergent and  
W-vergent tectonic slices

### (PAR)AUTOCHTHON (E part)

Pre-orogenic SE shelf and shelf margin facies  
Syn-orogenic foreland basin deposits  
A thin-skinned stack and, partly, a true autochthon

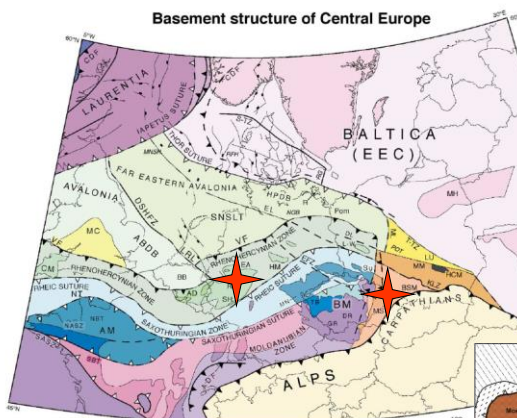
### MORAVO-SILESIA SHEAR ZONE

NNE trending zone of dextral shear,  
superimposed on thrusting



Kalvoda et al., 2006, Int J Earth Sci (Geol Rundsch) (2006) 97:487–516

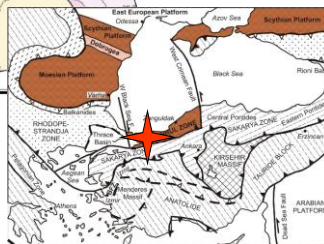
## Tectono-sedimentary correlation



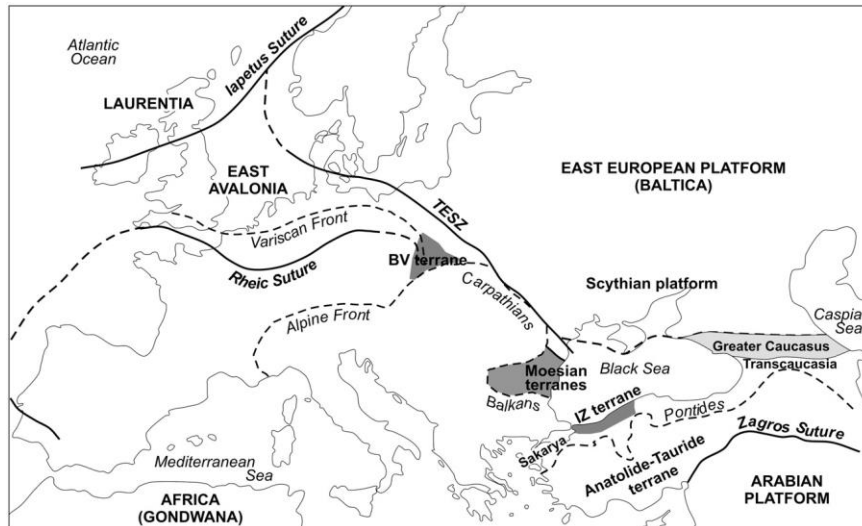
Devonian to Carboniferous  
sedimentation of the  
Brunovistulian Terrane  
shares common features  
with:

Rhenohercynian Zone of  
Germany in the W

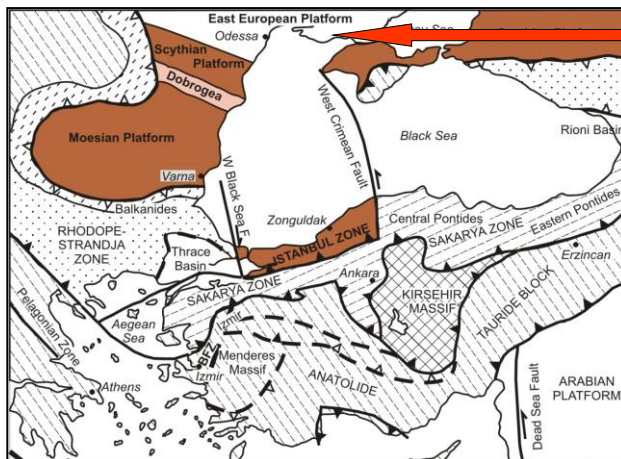
Istanbul Zone of Turkey in the  
SE



## Brunovistulian affinity to Moesian terranes and Istanbul Zone



## Correlation with the Istanbul Zone



Located along the Odessa shelf (S margin of East European platform) before the opening of the Black sea in Cretaceous

**Close paleobiogeographic match** (benthic foraminifera)

**Good lithologic match** in the Devonian and Carboniferous.

Deeper facies of the **Istanbul terrane** and **Zonguldak terrane** (southern part of the Istanbul Zone) correlate well with the SE (inner) shelf facies (**Ludmirov** and **Moravian Karst facies**, respectively)

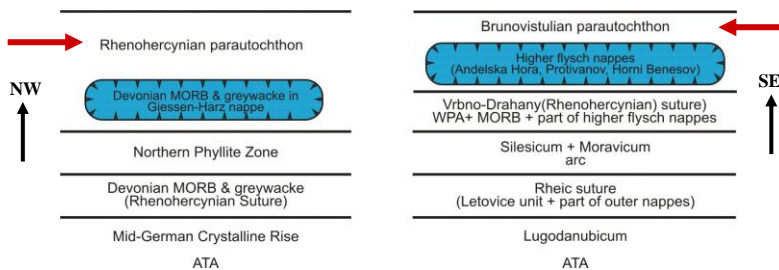


## (Par)autochthonous units

The SE shelf- and shelf margin facies (Moravian Karst and Ludmírov facies) correlate with the **Velbert** and **Stavelot-Venn anticlines**, northern parts of the **Rhenohercynian parautochthon**, in case of the latter presumably the zone **W of river Rhine** (Franke 1995).

The central basin facies (**Drahany facies**) correlate either with the Rhenohercynian parautochthon (**Lahn and Dill synclines**) or with the **allochthonous units of the Rhenohercynian Zone**

The parautochthonous flysch (Myslejovice, Rozstání, Moravice and Hradec-Kyjovice formations) correlate with the **Rhenohercynian Culm basin**



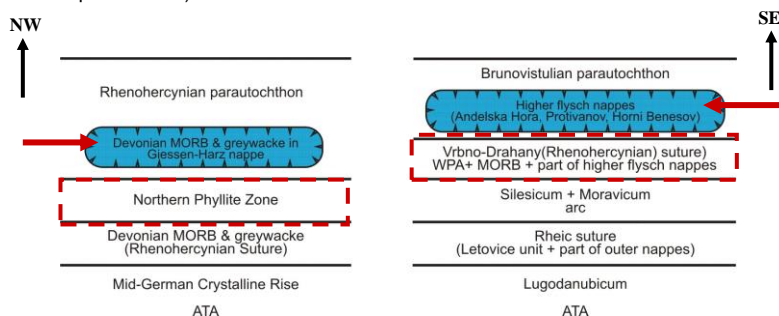
## Allochthonous units

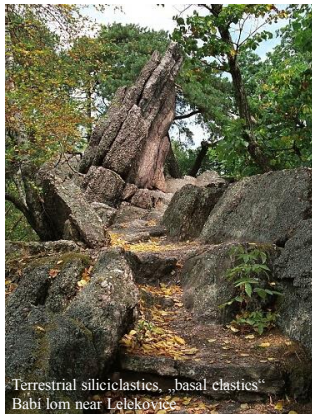
The NW shelf facies (Vrbno) correlate with the Northern Phyllite Zone, based on:

- faunistic relationships
- presence of arc volcanics of WPA and MORB geochemistry
- its position at the very margin of the Brunovistulian terrane

The allochthonous flysch + the Silurian exotics + (parts of) the central basin facies (**Drahany**) presumably correlate with the **Giessen-Harz nappe**, based on:

- structural position
- presence of slices of Silurian Bohemian facies
- detrital micas of Ordovician and Silurian age in synorogenic clastics (Armorican provenance)

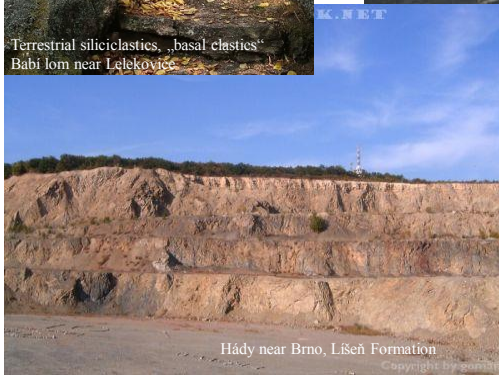




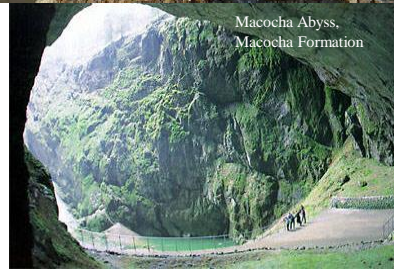
Terrestrial siliciclastics, "basal elastics"  
Babi lom near Lelekovice



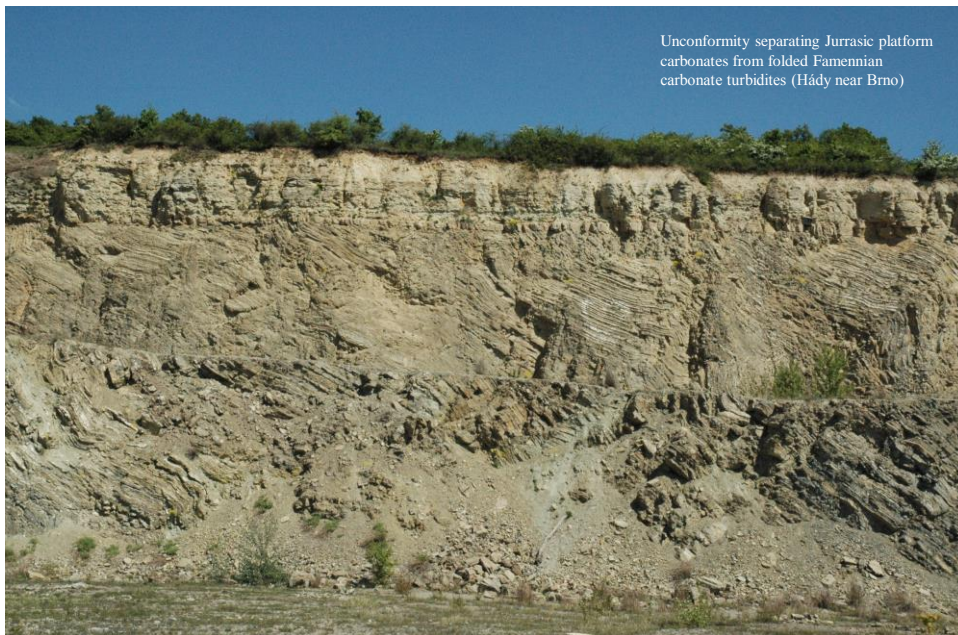
Mokra quarries, Macocha Formation



Hády near Brno, Liščí Formation



Macocha Abyss,  
Macocha Formation



Unconformity separating Jurassic platform  
carbonates from folded Famennian  
carbonate turbidites (Hády near Brno)

**Paleogeografické schéma spodního karbonu udávající  
předpokládanou pozici jednotlivých teránů**



**SEU – skupina  
intralpských  
teránů**

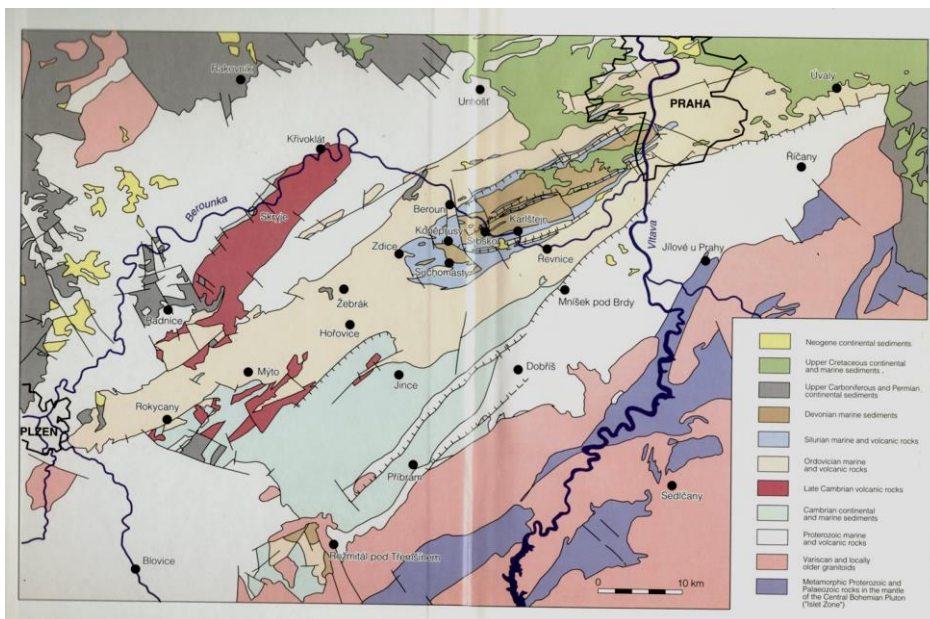
**Sa - Sakarya**

**T – Turanský  
blok**

**IST – istanbulska  
zóna**

**AT – anatolsko-  
taurský blok**

**Středočeská oblast**





## Středočeská oblast – Barrandien, Železné hory

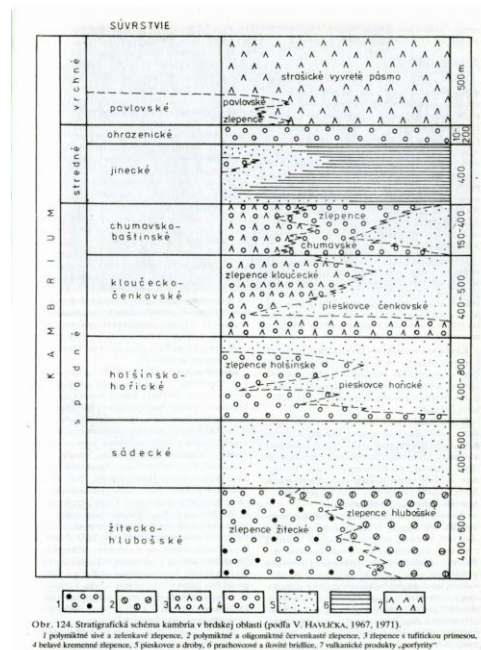
**Kambrium** – kadomská molasa, severní okraj Gondwany,  
mediterranní subprovincie, příbramsko-jinecká a skryjsko-týřovická  
Pánev, rožmitálský ostrov

- **Příbramsko-jinecká pánev** – kontinentální sedimentace (aluviální kužely, divočí říčky, méně lakustrinní sedimenty. Kodymirus vagans. Střední kambrium – jinecké souvrství – hojný trilobiti. Svrchní kambrium – fluviolakustrinní sedimenty, kyselé vulkanity strašického pásma
- **Skryjsko-týřovická pánev** – střední kambrium – marinní . Svrchní kambrium – Andesit-ryolitová asociace křivoklátsko-rokycanského pásma

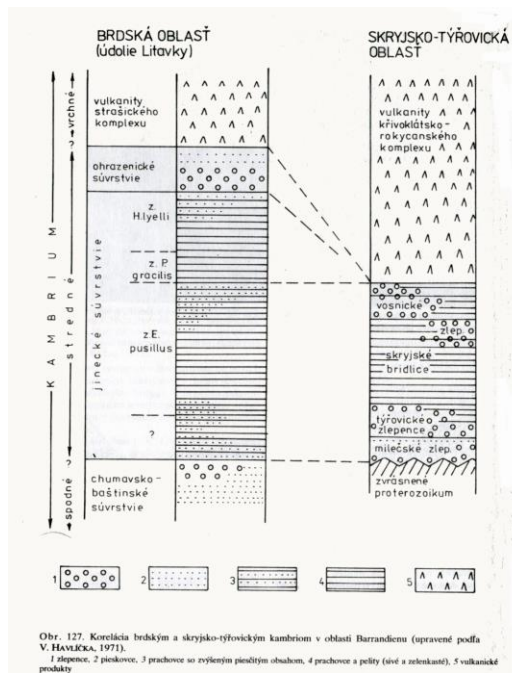
## Ordovik – devon

- **Pražská pánev**

**Příbramsko-jinecká pánev** – kontinentální sedimentace (aluviální kužely, divočí říčky, méně lakustrinní sedimenty. Kodymirus vagans. Střední kambrium – jinecké souvrství – hojný trilobiti. Svrchní kambrium – fluviolakustrinní sedimenty, kyselé vulkanity strašického pásma







## Skryjsko-týřovická

**pánev** – strední kambrium –  
marinní . Svrchní kambrium –  
Andesit-ryolitová asociace  
křivoklátsko-rokycanského  
pásma



Sao hirsuta, Middle Cambrian, Skryje

Sao hirsuta

## Pražská pánev

**Ordovik** – na kambriu se skrytou a na proterozoiku s úhlovou diskordancí

**Selenopeltisová bioprovincie** (chladné vody)

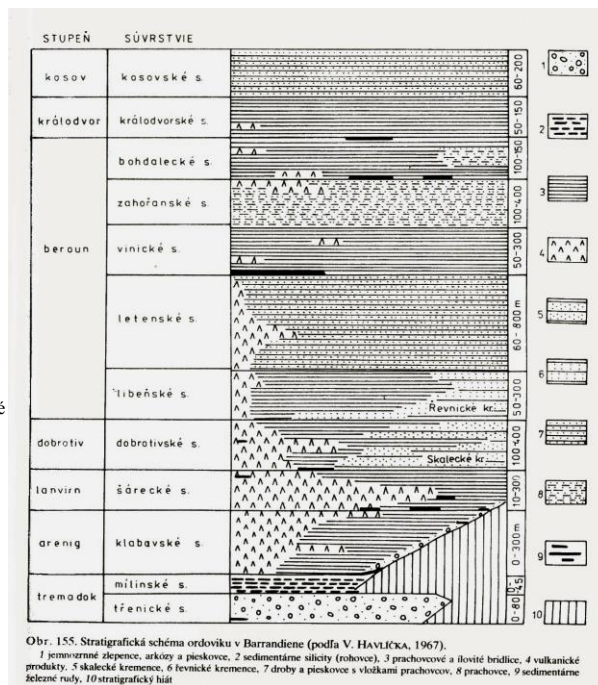
**Tremadok** – marinní a fluviomarinní pískovce, arkózy a droby, výše silicity

**Arenig až spodní beroun** –diferenciace, vulkanogenní sedimenty, hlubokomořské facie břidlice a prachovců, polohy sedimentárních železných rud, mělkovodní křemence

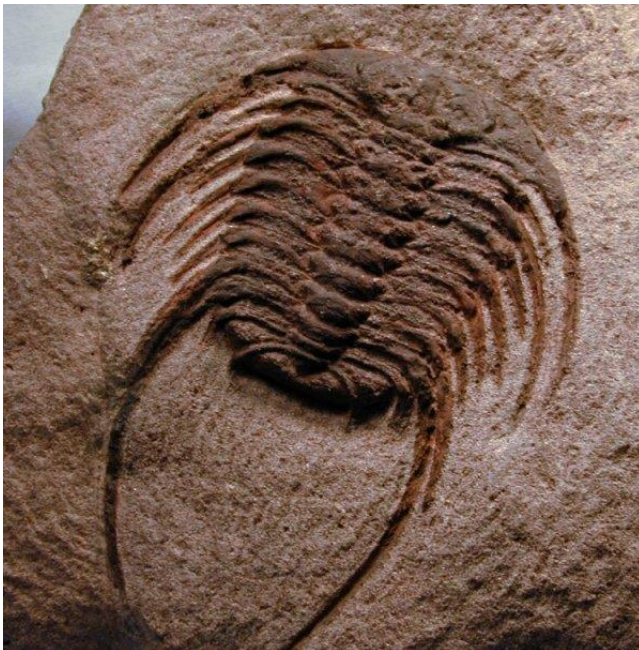
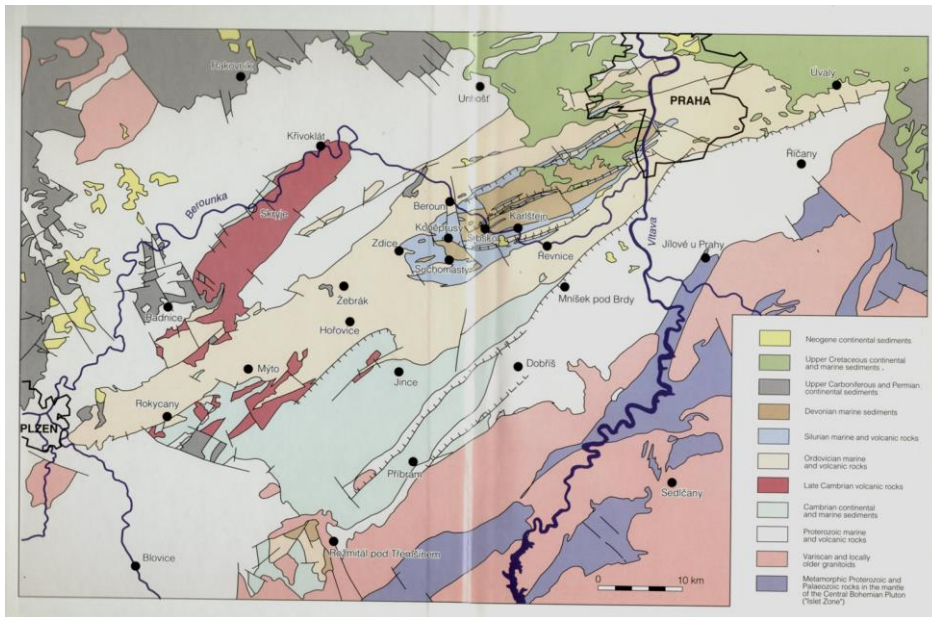
**Svrchní ordovik** – vulkanity vzácné, břidlice, prachovce, méně droby (letenské s.)

**Kosov** – hruběji klastické sedimenty (droby a pískovce), dropstony.

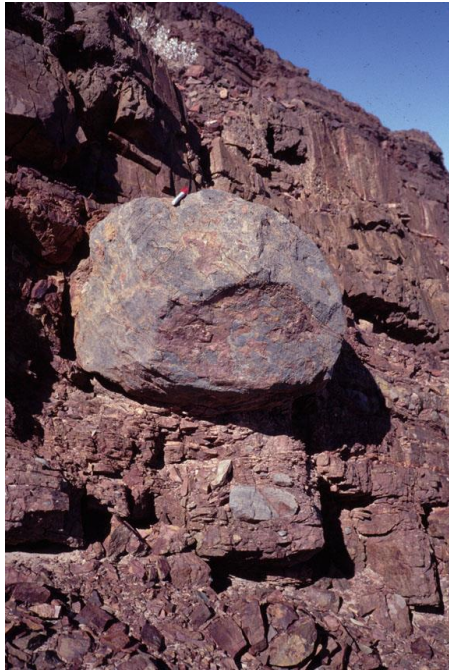
**diabasový vulkanismus** – bazická iniciální fáze variského tektonomagmatického cyklu



## Mapa výskytu ordoviku



Selenopeltis



Dropstones

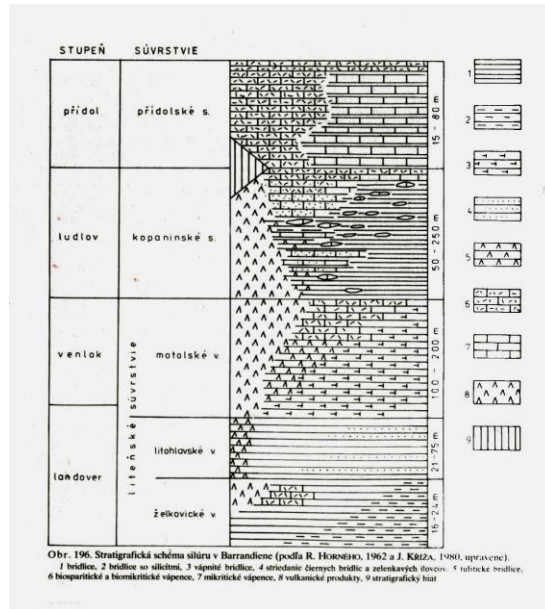
**Silur** – graptolitové břidlice, vápence, vulkanity.

**Llandovery** – břidlice.

**Wenlock-ludlow** – maximum vulkanické aktivity a faciálního rozrůznění, mělkovodní biostromové vápence, ortocerové vápence, graptolitové břidlice.

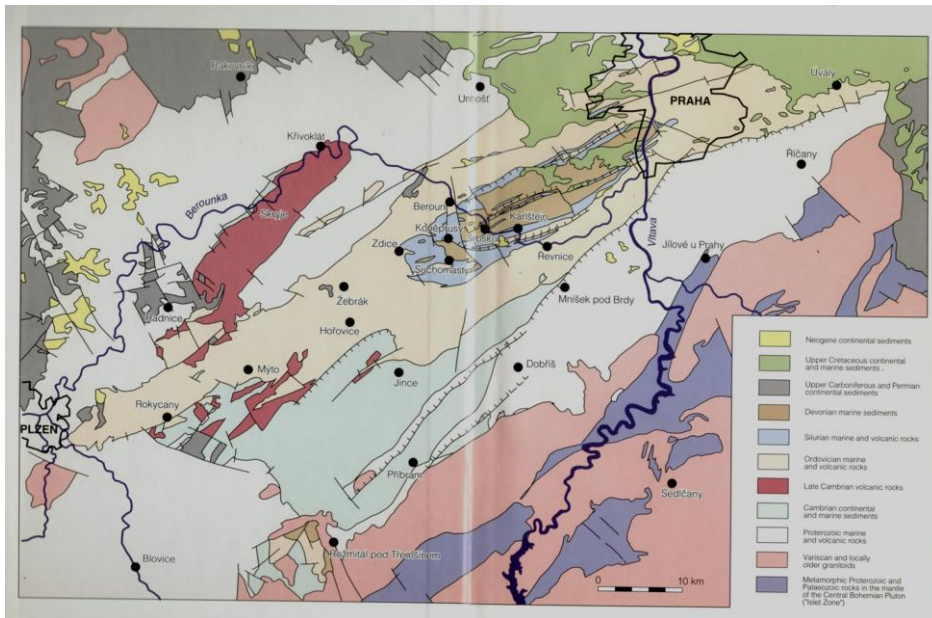
**Přídolí** – karbonáty, hranice silur/devon – scyphokrinitový horizont

**bazický až ultrabazický vulkanismus** oceánského typu



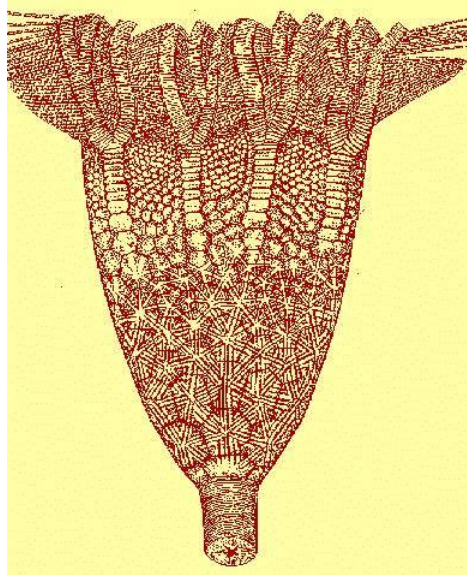


## Mapa výskytu siluru



**Aulacopleura konincki,**





## Devon –převaha karbonátů

**Lochkov** – lochkovské souvrství

**Prag** – maximální faciální diferenciace,  
koněpruské vápence

**Zlíchov** – hlavně hlíznaté vápence

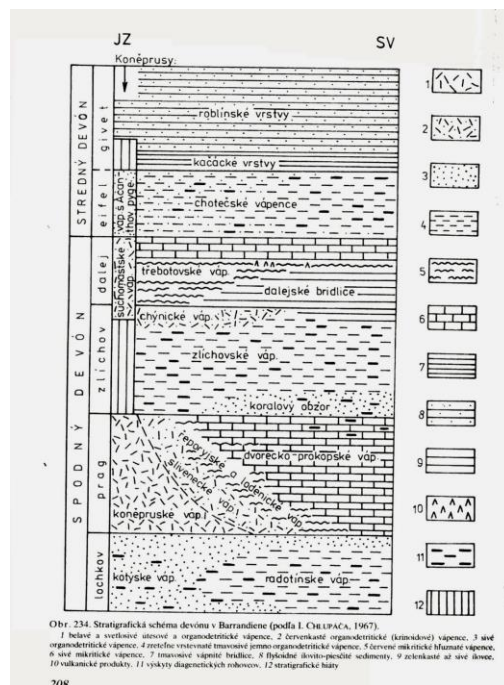
**Dalej** – dalejské tentakulitové břidlice,  
vápence

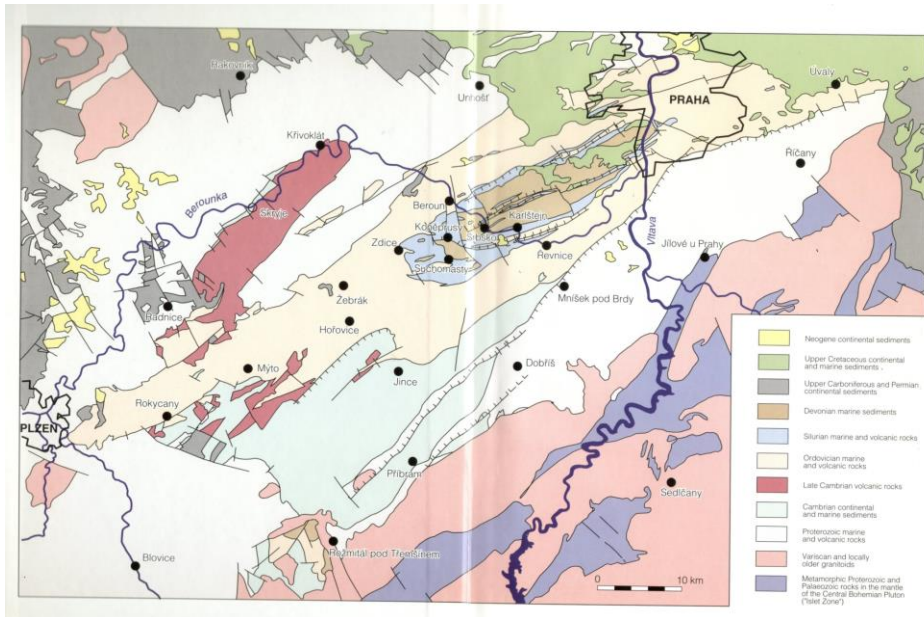
**Eifel** – bioklastické kalciturbidity,  
radiolariové rohovce

**Eifel/givet** – kačácké vrstvy, kačácký  
anoxický event

**Givet** – siliciklastické turbidity (variský  
flyš), nejvýše molasa (Koněprusy)

ve spodní části **doznívání**  
**bazaltoidního vulkanismu**





	SVRCHNÍ DEVON			
	FRASN	FAMEN		
STŘEDNÍ DEVON	GIVET	srbské s.	<div>eroze</div> <div>roblínské vrstvy</div> <div>kačácké vrstvy</div>	
	EIFEL	chotečské s.	akanto-pygové vápence	chotečské vápence
SPODNÍ DEVON	DALEJ	dalejsko - třebotovské s.	suchomastské vápence	<div>třebotovské vápence</div> <div>dalejské břidlice</div>
	ZLÍCHOV	zlíchovské s.		<div>chýnické vápence</div> <div>zlíchovské vápence</div> <div>korálový obzor</div>
	PRAG	pražské s.	<div>komárňanské váp.</div> <div>komárňanské váp.</div> <div>komárňanské váp.</div> <div>komárňanské váp.</div> <div>komárňanské váp.</div> <div>komárňanské váp.</div> <div>komárňanské váp.</div>	<div>komárňanské váp.</div> <div>komárňanské váp.</div> <div>komárňanské váp.</div> <div>komárňanské váp.</div> <div>komárňanské váp.</div> <div>komárňanské váp.</div> <div>komárňanské váp.</div>
	LOCHKOV	lochkovské s.	kotýské vápence	radotínské vápence

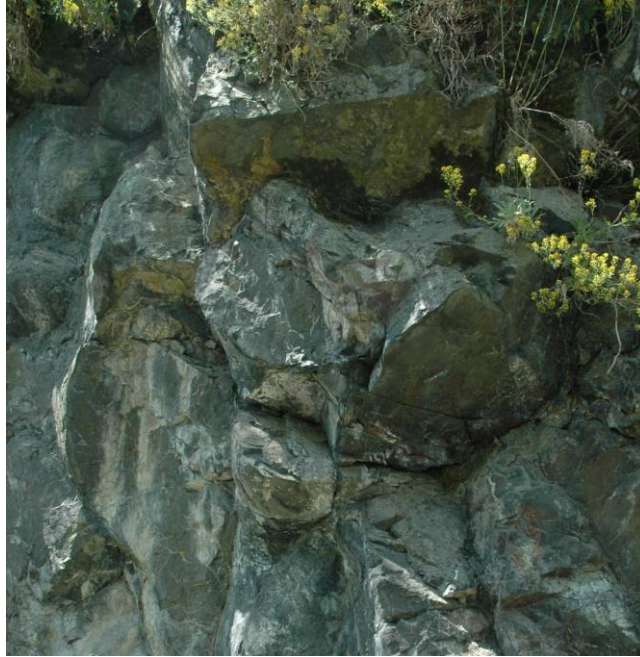
Obr. 45. Litostratigrafická tabulka Barrandienu v devonu (upraveno podle Miálk et al., 1985).













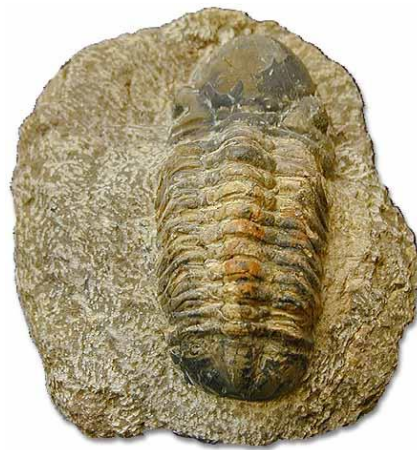




Phacops



## DEVONIAN



Reedops



## Tentaculites



**Moravskoslezská oblast**

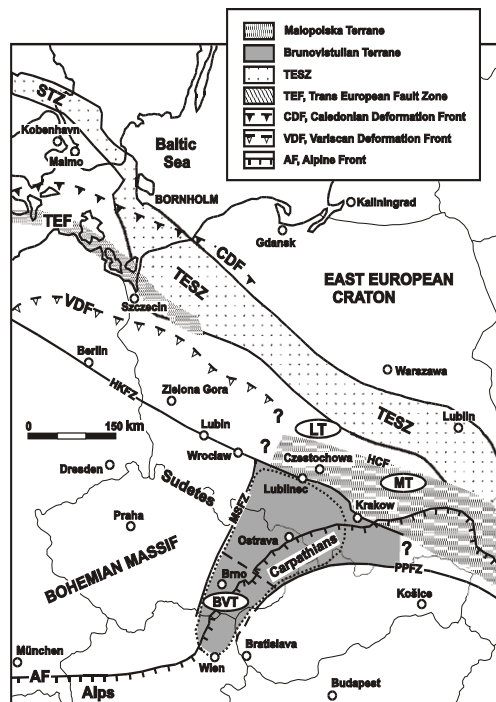
### Sedimentární pokryv brunovistulika

**Spodní kambrium** – mělkovodní mořské sedimenty, vrty jv od Brna

**Silur** – zasypaná štola u Stínavy, graptolitové a vápnité břidlice.

**Devon** – největší rozšíření ze spodního paleozoika

vývoj drahanský (pánev)  
vývoj ludmírovský (přechodný)  
vývoj Moravského krasu



**Paleogeografické schéma spodního karbonu udávající  
předpokládanou pozici jednotlivých teránů**



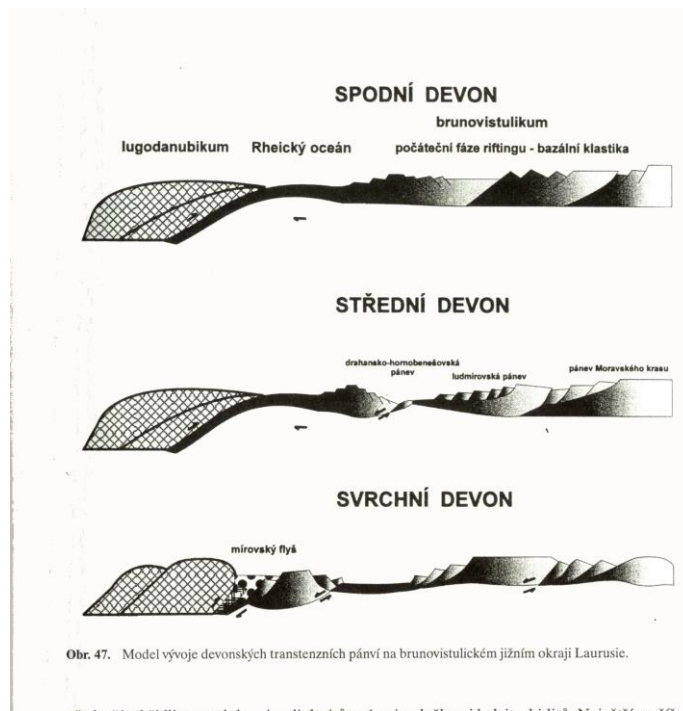
**SEU – skupina  
intraplatských  
teránů**

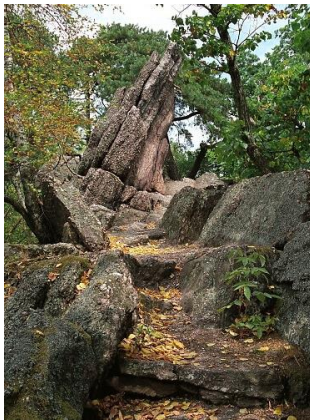
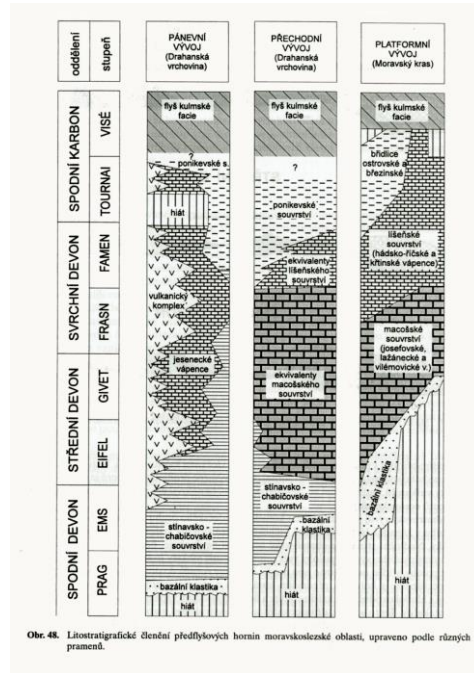
**Sa - Sakarya**

**T – Turanský  
blok**

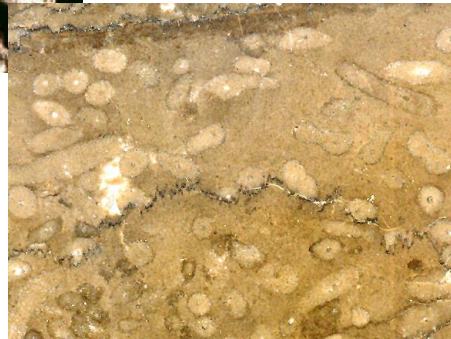
**IST – istanbulska  
zóna**

**AT – anatolsko-  
taurský blok**









*Amphipora ramosa*



Bornhardtina

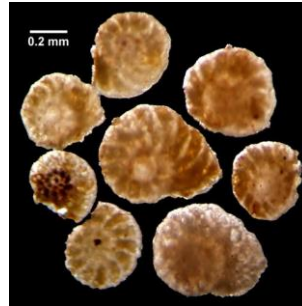


Clymenia



Clymenia

## Nanicella



## Palmatolepis

